

Phylum **Porifera** Grant, 1826¹ (4 classes of living species², 4 classes of fossil species³)

Class **Homoscleromorpha** Dendy, 1905 (1 order: no apparent fossil record)

Order **Homosclerophorida** Dendy, 1905 (2 families)

Family **Plakinidae** Schulze, 1880 (5 genera, 68 species)

Family **Oscarellidae** Lendenfeld, 1887 (2 genera, 17 species)

Class **Demospongiae** Sollas, 1885

Living Demospongiae (12 orders, one incertae sedis, and one genus *incertae sedis*)

Order **Spirophorida** Bergquist & Hogg, 1969 (3 families)

Family **Tetillidae** Sollas, 1886 (8 genera, 160 species)

Family **Samidae** Sollas, 1886 (1 genus, 1 species)

Family **Spirasigmidae** Hallmann, 1912 (2 genera, 2 species)

Order **Astrophorida** Sollas, 1888 (6 families)

Family **Ancorinidae** Schmidt, 1870 (15 genera, 303 species)

Family **Calthropellidae** Lendenfeld, 1906 (1 genus, 12 species)

Family **Geodiidae** Gray, 1867 (6 genera, 249 species)

Family **Pachastrellidae** Carter, 1875 (12 genera, 148 species)

Family **Thoosidae** Cockerell, 1925 (4 genera, 30 species)

Family **Thrombidae** Sollas, 1888 (2 genera, 7 species)

Order **Hadromerida** Topsent, 1928 (12 families)

Family **Acanthochaetidae** Fischer, 1970 (2 genera, 5 species)

Family **Clionaidae** d'Orbigny, 1851 (11 genera, 194 species)

Family **Hemasterellidae** Lendenfeld, 1889 (6 genera, 37 species)

Family **Placospongidae** Gray, 1867 (3 genera, 10 species)

Family **Polymastiidae** Gray, 1867 (15 genera, 122 species)

Family **Spirastrellidae** Ridley & Dendy, 1886 (2 genera, 21 species)

Family **Stylocordylidae** Topsent, 1928 (1 genus, 8 species)

Family **Suberitidae** Schmidt, 1870 (11 genera, 218 species)

Family **Tethyidae** Gray, 1867 (14 genera, 119 species)

Family **Timeidae** Topsent, 1928 (1 genus, 53 species)

Family **Trachycladidae** Hallmann, 1917 (2 genera, 8 species)

Order **Chondrosida** Boury-Esnault & Lopès, 1985 (2 families)

Family **Chondrillidae** Schmidt, 1862 (4 genera, 32 species)

Family **Halisarcidae** Vosmaer, 1885 (1 genus, 21 species)

'Order **Lithistida**' (polyphyletic, 13 families + 1 *incertae sedis*)

Family **Azoricidae** Sollas, 1888 (3 genera, 12 species)

1. BY John N.A. Hooper, Rob W.M. Van Soest & Andrzej Pisera (for full contact details, see **Author names, roles and addresses** after **References**). The title of this contribution should be cited as "Phylum Porifera Grant, 1826. In: Zhang, Z.-Q. (Ed.) Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness". Living Porifera includes 4 classes, 25 orders, 138 families, 722 genera, and 8,346 species as of 8 December 2012; fossil taxa include 4 classes, 34 orders, 191 families and 1032 genera, with a presently unknown number of described species.

2. **Living species:** The classification of Phylum Porifera follows the revision published in the *Systema Porifera* (Hooper & Van Soest, 2002), with recent additions and emendments published (e.g. Gazave et al. 2011) and online at the *World Porifera Database* (Van Soest et al., 2011). Only living taxa are recorded in this synopsis, with the fossil fauna still largely unreconciled with the living fauna at higher levels of classification, and also not easily retrievable at the lower levels of classification (Rigby, 2004). Only sponges with a solid calcareous skeleton (Calcarea and some Demospongiae with basal skeletons), articulated skeletons (lithistid sponges), or fused siliceous skeletons (Hexactinosa and Lychniscosa) have a good fossil record. Knowledge of most other groups is rudimentary at best.]

3. **Fossil species:** The classification presented here is modified and simplified from the 2004 Treatise on fossil sponges (Rigby 2004 in Finks, Reid and Rigby, 2004). The fossil sponge classification is not concordant with the living sponge classification at higher taxonomic levels, and hence both classifications are presented separately. Moreover, fossil taxa are also not easily retrievable at the lower levels of this palaeontological classification, and consequently only the ordinal level taxonomy is listed here. This listing gives the number of included families and genera indicated for each order, and an indication of the oldest and youngest known representatives of the taxon (although fossil occurrence is usually not continuous).

The sponge fossil record is adequate only for taxa with a solid skeleton (i.e. some of the Class Calcarea, demosponges with a basal calcareous skeleton, 'lithistid' demosponges, Hexactinosa and Lychniscosa hexactinellids). There is a fossil record for the soft-bodied sponge with skeletons composed only of loose spicules but this record is still only poorly studied and also difficult to interpret taxonomically. The fossil record for sponges that have no spicules is even more extremely poor. These latter two categories represent the majority of modern day species and possibly also of extinct species, and hence it can be said that sponges are generally only poorly known from the fossil record. Fossil groups with exclusively calcareous skeletons, such as the Archaeocyatha and Stromatoporoidea—often now regarded as sponges—are not included in this present list because no comprehensive paleontological study is yet available.]

Family **Corallistidae** Sollas, 1888 (5 genera, 33 species)

Family **Desmantidae** Topsent, 1893 (4 genera, 14 species)

Family **Isoraphinidae** Schrammen, 1924 (1 genus, 2 species)

Family **Macandrewiidae** Schrammen, 1924 (1 genus, 8 species)

Family **Neopeltidae** Sollas, 1888 (4 genera, 15 species)

Family **Phymaraphiniidae** Schrammen, 1924 (3 genera, 5 species)

Family **Phymatellidae** Schrammen, 1924 (3 genera, 9 species)

Family **Pleromidae** Sollas, 1888 (2 genera, 5 species)

Family **Scleritodermidiae** Sollas, 1888 (5 genera, 25 species)

Family **Siphonidiidae** Lendenfeld, 1903 (3 genera, 11 species)

Family **Theonellidae** Lendenfeld, 1903 (5 genera, 56 species)

Family **Vetulinidae** Lendenfeld, 1903 (1 genus, 1 species)

‘**Lithistida**’ *incertae sedis* (3 genera, 6 species)

Order **Poecilosclerida** Topsent, 1928 (4 suborders)

- Suborder **Microcionina** Hajdu, Van Soest & Hooper, 1994 (4 families)
 - Family **Acarnidae** Dendy, 1922 (13 genera, 121 species)
 - Family **Microcionidae** Carter, 1875 (9 genera (1 *incertae sedis*), 493 species)
 - Family **Raspailiidae** Hentschel, 1923⁴ (23 genera (2 *incertae sedis*), 246 species)
 - Family **Rhabderemiidae** Topsent, 1928 (1 genus, 30 species)
- Suborder **Myxillina** Hajdu, Van Soest & Hooper, 1994 (11 families)
 - Family **Chondropsidae** Carter, 1886 (5 genera, 80 species)
 - Family **Coelosphaeridae** Hentschel, 1923 (8 genera, 208 species)
 - Family **Crambeidae** Lévi, 1963 (4 genera, 28 species)
 - Family **Crellidae** Hentschel, 1923 (5 genera, 77 species)
 - Family **Dendoricellidae** Hentschel, 1923 (3 genera, 17 species)
 - Family **Desmacididae** Schmidt, 1873 (2 genera, 13 species)
 - Family **Hymedesmiidae** Topsent, 1928 (10 genera, 284 species)
 - Family **Itrochotidae** Dendy, 1922 (6 genera, 32 species)
 - Family **Myxillidae** Topsent, 1928 (8 genera, 136 species)
 - Family **Phellogermidae** Van Soest & Hajdu, 2002 (2 genera, 11 species)
 - Family **Tedaniidae** Ridley & Dendy, 1886 (3 genera, 84 species)
- Suborder **Mycalina** Hajdu, Van Soest & Hooper, 1994 (9 families)
 - Family **Cladorhizidae** de Laubenfels, 1936 (6 genera, 113 species)
 - Family **Desmacellidae** Ridley & Dendy, 1886 (6 genera, 110 species)
 - Family **Esperiopsidae** Hentschel, 1923 (4 genera, 71 species)
 - Family **Guitarridae** Burton, 1929 (4 genera, 25 species)
 - Family **Hamacanthidae** Gray, 1872 (2 genera, 27 species)
 - Family **Isodictyidae** Dendy, 1924 (2 genera, 44 species)
 - Family **Merliidae** Kirkpatrick, 1908 (1 genus, 4 species)
 - Family **Mycalidae** Lundbeck, 1905 (2 genera, 245 species)
 - Family **Podospongiidae** de Laubenfels, 1936 (7 genera, 31 species)
- Suborder **Latrunculina** Kelly & Samaai, 2002 (1 family)
 - Family **Latrunculiidae** Topsent, 1922 (5 genera, 51 species)

Order **Halichondrida** Gray, 1867 (5 families)

- Family **Axinellidae** Carter, 1875 (11 genera, 225 species)
- Family **Bubaridae** Hentschel, 1914 (4 genera, 27 species)
- Family **Dictyonellidae** Van Soest, Diaz & Pomponi, 1990 (10 genera, 101 species)
- Family **Halichondriidae** Vosmaer, 1887 (14 genera (3 *incertae sedis*), 290 species)
- Family **Heteroxyidae** Dendy, 1905⁵ (12 genera (1 *incertae sedis*), 63 species)

Order **Agelasida** Hartman, 1980 (2 families)

4. Hooper & van Soest (2002) list Sollasellidae Lendenfeld (1887) with single genus *Sollasella* Lendenfeld (1888) as a family of Hadromerida, but subsequent studies (van Soest et al. 2006; Erpenbeck et al. 2007) identified this as a genus of Raspailiidae

5. Hooper (2002) lists Family Desmoxyidae Hallmann, 1917 as the valid name for this taxon, but Dendy’s earlier name Heteroxyidae takes priority (Van Soest & Hooper, 2005)

Family **Agelasidae** Lister, 1900 (1 genus, 35 species)

Family **Astroscleridae** Verril, 1907 (5 genera, 7 species)

Order **Haplosclerida** Topsent, 1928 (3 suborders)

- Suborder **Haplosclerina** Topsent, 1928 (3 families)
 - Family **Callyspongiidae** de Laubenfels, 1936 (4 genera, 214 species)
 - Family **Chalinidae** Gray, 1867 (6 genera (1 *incertae sedis*), 478 species).
 - Family **Niphatidae** Van Soest, 1980 (9 genera, 157 species)
- Suborder **Petrosina** Boury-Esnault & Van Beveren, 1982 (3 families)
 - Family **Phloeodictyidae** Carter, 1882 (5 genera, 122 species)
 - Family **Petrosiidae** Van Soest 1980 (4 genera, 125 species)
 - Family **Calcifibrospongiidae** Hartman, 1979 (1 genus, 1 species)
- Suborder **Spongillina** Manconi & Pronzato, 2002 (6 families of living sponges, + 1 *incertae sedis*)
 - Family **Lubomirskiidae** Rezvoi, 1936 (4 genera, 11 species)
 - Family **Malawispongiidae** Manconi & Pronzato, 2002 (5 genera, 6 species)
 - Family **Metaniidae** Volkmer-Ribeiro, 1986 (5 genera, 27 species)
 - Family **Metschnikowiidae** Czerniawsky, 1880 (1 genus, 1 species)
 - Family **Potamolepidae** Brien, 1967 (6 genera, 31 species)
 - Family **Spongillidae** Gray, 1867 (24 genera, 173 species)
 - Family **Spongillina** *incertae sedis* (4 genera, 4 species)

Order **Dictyoceratida** Minchin, 1900 (5 families)

- Family **Ircinidae** Gray, 1867 (3 genera, 110 species)
- Family **Thorectidae** Bergquist, 1978 (24 genera, 167 species)
- Family **Spongiidae** Gray, 1867 (7 genera (1 *incertae sedis*), 182 species).
- Family **Dysideidae** Gray, 1867 (6 genera (1 *incertae sedis*), 90 species)
- Family **Verticillitidae** Steinmann, 1882⁶ (Living fauna has 1 genus, 1 species)

Order **Dendroceratida** Minchin, 1900 (2 families)

- Family **Darwinellidae** Merejkowsky, 1879 (4 genera, 45 species)
- Family **Dictyodendrillidae** Bergquist, 1980 (4 genera, 26 species)

Order **Verongida** Bergquist, 1978 (4 families)

- Family **Aplysinellidae** Bergquist, 1980 (3 genera, 14 species)
- Family **Aplysinidae** Carter, 1875 (3 genera, 54 species)
- Family **Ianthellidae** Hyatt, 1875 (3 genera, 19 species)
- Family **Pseudoceratinidae** Carter, 1885 (1 genus, 6 species)

Demospongiae *incertae sedis* (1 genus, 1 species (*Myceliospongia*))

Fossil Demospongiae (4 subclasses, 22 orders, 9 suborders)

- Subclass **Clavixinellida** Levi 1956 Cryogenian - Holocene
 - Order **Protomonaxonida** Finks and Rigby 2004 Cryogenian-Holocene (14 families, 39 genera)
 - Order **Hadromerida** Topsent, 1928⁷ Ordovician-Holocene (4 families, 15 genera)
- Subclass **Choristida** Sollas 1880 Ordovician - Holocene
 - Order **Plakinida** Reid 1968, Lower Cretaceous- Holocene (3 families, 5 genera)
 - Order **Pachastrellida** Reid, 2004, Carboniferous –Holocene (3 families, 13 genera)
 - Order **Ancorinida** Reid 1968 Carboniferous –Holocene (3 families, 19 genera)
 - Order **Craniellida** Reid 1968, Upper Cretaceous – Holocene (1 family, 2 genera)
 - Order **incertae sedis** (3 families, 13 genera, Jurassic to Neogene)
- Subclass **Tetractinomorpha** Levi, 1953 Ordovician - Holocene
 - Order **Streptosclerophorida** Dendy, 1924 Middle Ordovician –Holocene
 - Suborder **Eutaxicladina** Rauff, 1894 Middle Ordovician – Permian (1 family, 13 genera)
 - Order **Hadromerida** Topsent 1898, Permian – Holocene (3 families, 17 genera)
- Subclass **Ceractinomorpha** Levi, 1953 Cambrian - Holocene
 - Order **Dictyoceratida** Minchin 1900 Lower Jurassic – Holocene (2 families, 5 genera)

6. Up until 2007 the genus *Vaceletia* (with a single Recent species) was included in the otherwise exclusive fossil Order Verticillitida Termier et al., 1997, previously allocated to a 'Class Sphinctozoa' Steinmann, 1882 (polyphyletic). Recent molecular evidence shows the living species is a member of the Dictyoceratida (Wörheide, 2008).

7. Palaeontological authors also use the taxon 'Order Clavulina Vosmaer, 1887' for this clade.

Order **Verongida** Baerquist, 1978 Middle Cambrian – Holocene (2 families, 3 genera)

Order **Halichondrida** 1898, Paleogene – Holocene (1 family, 1 genus)

Order **Poecilosclerida** Topsent, 1928 Cretaceous- Holocene (6 families, 16 species)

Order **Haplosclerida** Topsent, 1898 Jurassic- Holocene (4 families, 18 species)

Order **Agelasida** Verrill 1907 Ordovician – Triassic (25 families, 145 species)

Order **Vaceletida** Finks and Rigby 2004 Lower Cambrian – Triassic (8 families, 51 species)

Order **Sigmatosclerophorida** Burton, 1956 ⁸Ordovician –Holocene (1 family, 4 genera)

Subclass **Lithistida** Schmidt, 1870 Cambrian- Holocene

Order **Orchocladina** Rauff, 1895 Middle Cambrian-Permian (5 families, 114 genera)

Order **Tetralithistida** Lagneau-Herenger 1962 Upper Triassic- Holocene

- Suborder **Tetracladina** Zittel 1878 Upper Triassic – Holocene (8 families 70 genera)
- Suborder **Dicranocladina** Schrammen 1924 Upper Jurassic-Holocene (2 families, 16 species)
- Suborder **Pseudorhizomorina** Schrammen, 1901 Cretaceous-Holocene (2 families, 2 genera)
- Suborder **Didymorina** Rauff, 1893 Middle-Upper Jurassic (1 family, 5 species)

Order **Megalithistida** Reid, 2004 Lower Ordovician –Holocene

- Suborder **Helomorina** Schrammen 1924 Upper Jurassic- Upper Cretaceous (1 family, 6 species)
- Suborder **Megamorina** Zittel, 1878 Lower Ordovician-Holocene (4 families, 22 genera)

Order **Axinellida** Berquist 1967 Permian-Holocene (1 family, 1 species)

Order **Monolithistida** Lagneau-Herenger 1955 Lower Jurassic -Holocene

- Suborder **Megarhizomorina** Schrammen 1924 Upper Cretaceous
- Suborder **Sphaerocladina** Schrammen, 1910 Lower Jurassic-Holocene (2 families, 16 genera)

Order **Spirosclerophorida** Reid, 1963 Middle Cambrian-Holocene

- Suborder **Rhizomorina** (10 families, 114 genera)

Class **Calcarea** Bowerbank, 1864

Living Calcarea (2 subclasses)

Subclass **Calcinea** Bidder, 1898 (2 orders)

Order **Clathrinida** Hartman, 1958 (6 families, +1 *incertae sedis*)

- Family **Clathrinidae** Minchin, 1900 (2 genera, 86 species)
- Family **Leucaltidae** Dendy & Row, 1913 (4 genera, 18 species)
- Family **Leucascidae** Dendy, 1893 (2 genera, 16 species)
- Family **Leucettidae** de Laubenfels, 1936 (2 genera, 24 species)
- Family **Soleneiscidae** Borojevic, Boury-Esnault & Vacelet, 1990 (2 genera, 13 species)
- Family **Levinellidae** Borojevic & Boury-Esnault, 1986 (3 genera, 4 species)
- Clathrinida** *incertae sedis* (1 genus (*Leucomalthe*), 1 species)

Order **Murrayonida** Vacelet, 1981 (3 families)

- Family **Lelapiellidae** Borojevic, Boury-Esnault & Vacelet, 1990 (1 genus, 2 species)
- Family **Murrayonidae** Dendy & Row, 1913 (1 genus, 1 species)
- Family **Paramurrayonidae** Vacelet, 1967 (1 genus, 1 species)

Subclass **Calcaronea** Bidder, 1898 (3 orders)

Order **Leucosolenida** Hartman, 1958 (9 families)

- Family **Leucosoleniidae** Minchin, 1898 (3 genera, 47 species)
- Family **Amphoriscidae** Dendy, 1892 (3 genera, 33 species)
- Family **Grantiidae** Dendy, 1892 (11 genera, 208 species)
- Family **Heteropiidae** Dendy, 1893 (7 genera, 65 species)
- Family **Lelapiidae** Dendy & Row, 1913 (5 genera, 8 species)
- Family **Sycettidae** Dendy, 1892 (2 genera, 94 species)
- Family **Jenkinidae** Borojevic, Boury-Esnault & Vacelet, 2000 (6 genera, 11 species)
- Family **Achramorphidae** Borojevic, Boury-Esnault, Manuel & Vacelet, 2002 ⁹ (2 genera, 10 species)
- Family **Sycanthidae** Lendenfeld, 1891 (2 genera, 4 species)

Order **Lithonida** Vacelet, 1981 (2 families)

8. This taxon is considered by neontological authors to contain ancestors of the Recent Haplosclerida and Poecilosclerida, and as such is possibly artificial

9. Family Staurorrhaphidae Jenkin, 1908 was previously used as the valid name for this taxon but was determined to be a *nomen nudum* (Van Soest, 2010)

Family **Minchinellidae** Dendy & Row, 1913 (5 genera, 19 species)

Family **Petrobionidae** Borojevic, 1979 (1 genus, 1 species)

Order **Baerida** Borojevic, Boury-Esnault & Vacelet, 2000 (3 families)

Family **Baeriidae** Borojevic, Boury-Esnault & Vacelet, 2000 (4 genera, 12 species)

Family **Trichogypsiidae** Borojevic, Boury-Esnault & Vacelet, 2000 (3 genera, 5 species)

Family **Lepidoleuconidae** Vacelet, 1967 (1 genus, 1 species)

Fossil species of Calcarea: Lower Cambrian – Holocene (1 subclass, 4 orders)

Subclass **Calcaronea** Bidder 1898 Lower Carboniferous - Holocene

Order **Sycettida** Bidder 1898 Carboniferous – Holocene (2 families, 4 genera)

Order **Stellispongiida** Finks and Rigby, 2004 Permian – Holocene (2 families, 30 genera)

Order **Sphaerocoeliida** Vacelet 1967 Permian – Cretaceous (1 family, 5 genera)

Order **Lithonida** Doederlein 1892 Jurassic – Holocene (1 family, 10 genera)

Class **Hexactinellida** Schmidt, 1870

Living Hexactinellida (2 subclasses)

Subclass **Amphidiscophora** Schulze, 1886 (1 order)

Order **Amphidiscosida** Schrammen, 1924 (3 families)

Family **Hyalonematidae** Gray, 1857 (5 genera, 129 species)

Family **Monorhaphididae** Ijima, 1927 (1 genus, 1 species)

Family **Pheronematidae** Gray, 1870 (6 genera, 45 species)

Subclass **Hexasterophora** Schulze, 1886 (5 orders)

Order **Hexactinosida** Schrammen, 1903 (8 families, + 1 *incertae sedis*)

Family **Aphrocallistidae** Gray, 1867 (2 genera, 12 species)

Family **Auloplacidae** Schrammen, 1912 (1 genus, 4 species)

Family **Craticulariidae** Rauff, 1893 (1 genus, 1 species)

Family **Cribrospongiidae** Roemer, 1864 (1 genus, 1 species)

Family **Dactylocalyctidae** Gray, 1867 (2 genera, 7 species)

Family **Euretidae** Zittel, 1877 (17 genera, 67 species)

Family **Farreidae** Gray, 1872 (6 genera, 61 species)

Family **Tretodictyidae** Schulze, 1886 (8 genera, 30 species)

Hexactinosida *incertae sedis* (4 genera, 4 species)

Order **Aulocalycoidea** Tabachnick & Reiswig, 2000 (2 families)

Family **Aulocalyctidae** Ijima, 1927 (6 genera, 8 species)

Family **Uncinateridae** Reiswig, 2002 (2 genera, 3 species)

Order **Fieldingida** Tabachnick & Janussen, 2004 (1 family)

Family **Fieldingiidae** Tabachnick & Janussen, 2004¹⁰ (1 genus, 4 species)

Order **Lychniscosida** Schrammen, 1903 (2 families)

Family **Aulocystidae** Schulze, 1886 (2 genera, 6 species)

Family **Diapleuridae** Ijima, 1927 (1 genus, 3 species)

Order **Lyssacinosida** Zittel, 1877 (3 families)

Family **Euplectellidae** Gray, 1867 (27 genera, 99 species)

Family **Leucopsacidae** Ijima, 1903 (5 genera, 12 species)

Family **Rossellidae** Gray, 1872 (22 genera, 192 species)

Fossil Hexactinellida: Lower Cambrian – Holocene (2 subclasses, 6 orders)

Subclass **Amphidiscophora** Schulze, 1887 Lower Cambrian – Holocene

Order **Amphidiscosa** Schrammen 1924 Lower Cambrian- Holocene (4 families, 41 genera)

Order **Reticulosa** Reid, 1958 Ediacaran – Holocene (12 families 118 genera)

Order **Hemidiscosa** Schrammen, 1924 Carboniferous (1 family, 1 genus)

Subclass **Hexasterophora** Schulze 1887 Ordovician – Holocene

Order **Lyssacinosa** Zittel 1877 (12 families, 36 genera)

Order **Hexactinosa** Schrammen 1903 Upper Ordovician- Holocene (18 families, 134 genera)

Order **Lycniscosa** Schrammen, 1903 Jurassic- Holocene (10 families, 81 genera)

Class **Heteractinida** de Laubenfels, 1955 Lower Cambrian- Permian (2 orders, fossil species only)

10. This order and family were newly erected by Tabachnick *et al.* 2004 for the genus *Fieldingia* which was previously assigned to Hexactinosida *incertae sedis*

Order **Octactinellida** Hinde, 1887 (4 families, 32 genera)

Order **Hetairacyathida** Bedford and Bedford 1937 Lower Cambrian (1 family, 4 genera)

Fossil Porifera incertae sedis: (3 families, 46 genera)

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